SUMMATIVE EVALUATION OF A BACCALAUREATE NURSING INFORMATICS CURRICULUM

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This paper describes the fifth stage in the process of designing, implementing and evaluating the nursing informatics courses incorporated into a baccalaureate nursing program. The challenge is to construct an evolving nursing informatics curriculum so as to provide nursing professionals with the foundations for affecting health care delivery. The basic components of the curriculum framework are information, technology, and clinical care process. Information on the two groups of graduates who have completed the four course sequence and the one group of graduates who have been in practice will be discussed.

Health care in the future will differ greatly from health care today. Health professional being prepared at the end of the 20th century will be active in patient care through the year 2050. They will require different skills, values and attitudes to succeed in the changing health care system. Health care will be increasingly driven by information, and consequently patient care will demand effective management of information. Preparing health care professionals to use information technology is a challenge that needs to be addressed by educational programs. The school of nursing successfully implemented a novel nursing informatics core within a BSN program, and has reported annually on its progress. We will also report on the current status of the courses.

Importantly, this paper reports on the five year evaluation of the curriculum in nursing informatics. The evaluation plan follows a triangulated strategy, via pencil-and-paper evaluation of students' knowledge and attitudes, course product outcome and performance appraisal by employers following graduation. Data were obtained from two groups of students who have completed the entire curriculum: the 1994 graduates who have been employed for one year and the 1995 graduates.

BACKGROUND AND CURRICULUM

As stated by the American Association of Colleges of Nursing's Agenda for Nursing Education for the 21st Century, preparation of nursing professionals to face the challenges of health care in the 21st century requires ability to anticipate and prepare to educate students for this new environment.[1] The report of Priority Expert Panel E: Nursing Informatics[2] and recently published *Enhancing Clinical Care Through Nursing Informatics*[3] challenges faculty to produce a baccalaureate graduate who uses information technologies improve the patient care process and change health care. In addition, based on the recommendations by Peterson Gerdin-Jelger[4] and Ronald & Skiba[5] we designed our curriculum to give students experience to learn accepted practices, as well as give them opportunities to try out new approaches and modalities of care.[6]

The first course, Introduction to Nursing Informatics (2 credits), emphasizes information and technology with an overlap in the clinical care process. In Nursing Informatics II (1 credit) students learn to handle quantitative information within the clinical area[7,8], information and its relationship to the research process and epidemiological concepts. In Nursing Informatics III: Clinical Nursing Information Systems (2 credits), students focus on an overlap of the three areas, information, technology and clinical care and their use to support the nursing management process in the clinical setting. The culminating course in the nursing informatics sequence, Nursing Informatics IV: Applications (2 credits) is designed to provide hands-on experience for the student in selected areas of application in nursing informatics.[7,8,9,10]

UPDATE ON INFORMATICS I, II, III, IV

First level students are exposed to a data to knowledge transformation though a series of in class group exercises and lectures. These exercises utilize the students beginning knowledge of the Nursing Minimum Data Set in the development of a database specific to an area of practice, ie. inpatient, community, rehabilitation facility. Additionally, the first year students are given the opportunity to develop a nursing informatics system using instructor specified parameters and conceptual knowledge.

Second level students demonstrate their increased knowledge base through development and presentation of a project independently determined by clinical groups. The students are free to utilize any university or network

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resources including the computer simulations previously discussed in these articles. Recently developed projects included a new patient acuity system, surveys of previous classes and their use of simulation packages, a critique of the sixteen elements of the Nursing Minimum Data Set and an exploration of faculty and student attitudes toward the use of virtual reality as a knowledge enhancement tool. Students in the second year of the tract see an increased emphasis on nursing research as evidenced by their use of surveys and resulting data analysis. An increased emphasis on epidemiologic concepts and biostatistics is also seen within this year of the program.

Third level students explore the entire spectrum of informatics technologies available within and outside of nursing. Introduction of the student to electronic resources such as the Virginia Henderson Electronic Library of Sigma Theta Tau, the Nightingale gopher and the Virtual Hospital of the University of Iowa, allows integration of technology and knowledge as well as an application to real problems soon to be encountered in practice. A continued emphasis on nursing research and its relationship to informatics gives rise to individual exploration of topics such as virtual reality, the use of a universal, electronic medical record, robotics in health care, and the issues of privacy, security and confidentiality of patient information. The increased flexibility and independence within this course prepares the student for the fourth level informatics course which emphasizes application of previous informatics knowledge.

The fourth level course has just been offered for a second time. In order to keep pace with the evolving environment, the fourth course was updated after the first offering. To assist students in developing knowledge and skills about evolving technologies, the project for the second offering of the fourth informatics course centered around the development of a home page for the school of nursing titled NurseWeb. The challenges included designing the WWW server content and interface, acquiring the content or the pathways to it, and implementing the hypertext markup language (HTML), home pages and other pointers to relevant information. Student teams worked closely with the nurses in their clinical agencies and with each other to design and build NurseWeb, a WWW server for nursing.

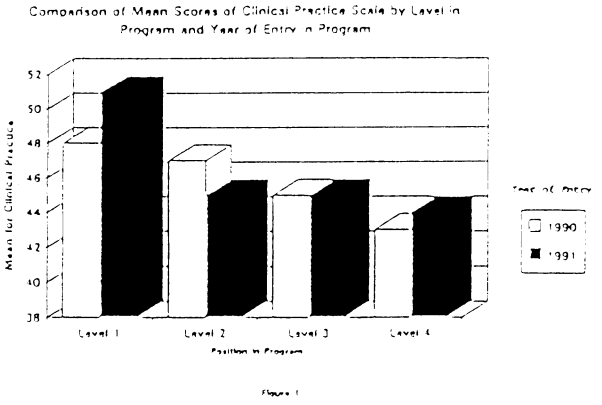
To accomplish the project, 13 teams, each including about 8-10 people were formed. For each of the three clinical sites, there was a Site Design Team, Site Development Team, and a Site Technical Team. There was also an Executive Team, a Design Coordinating Team, a Development Coordinating Team, and a Technical Coordinating Team. Utilizing team building concepts as well as information management concepts the teams worked together to develop the final product.

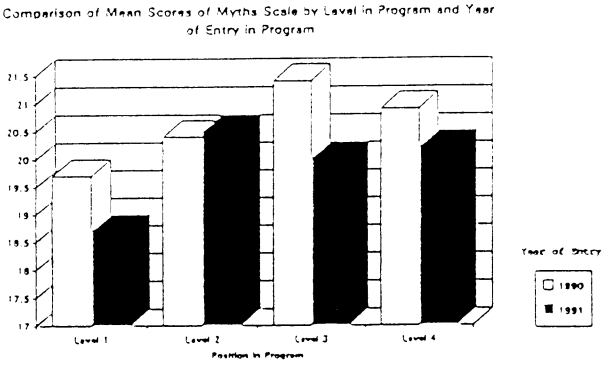
In developing Nurse Web, we had an unusual opportunity to build an electronic information resource for the school of nursing, the nurses at the affiliated clinical agencies, and nurses all over the world. NurseWeb is a World Wide Web (WWW) server, (**http://cwnur4.cwru.edu**) housed at the school of nursing, and providing actual resources or pathway access to resources helpful to nursing and to patient care. It involved the combined efforts of all senior students, faculty and support of the University's Information Network Service. NurseWeb is one of a few WWW servers devoted exclusively to information to support clinical nursing. NurseWeb represents a compilation of pathways to clinically relevant sources on the Internet.

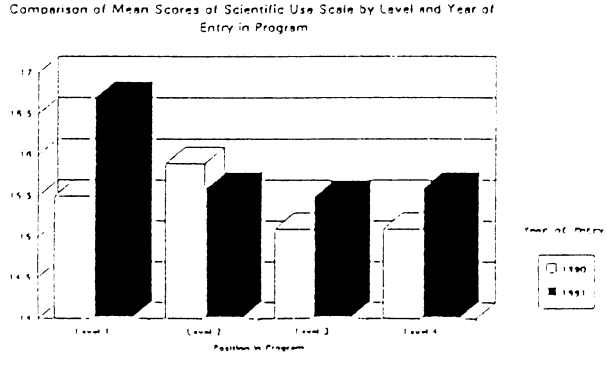
PROGRAM EVALUATION

Knowledge and Attitude of Students. This is the fifth stage of a longitudinal study that has extended over a five year period. Evaluation of outcomes with respect to both students' attitudes and knowledge acquired has occurred after each stage. In addition to following the first cohort of students through the five year period, a comparison between the first group of students and succeeding student cohorts will occur. At the end of the present courses, the survey previously developed to evaluate the students' knowledge and attitudes toward computers and nursing informatics has been readministered so that an ongoing evaluation of changes in knowledge and attitude has been captured.[7,8]

The instrument to be used for this study is a 30 item questionnaire adapted from McConnell, O'Shea, and Kirchhoff.[11] As previously reported, factor analysis on the first sample supported a three factor structure and deletion of six items. The three scales are scientific use of technology, common misconceptions (myths) associated with technological advances, and clinical care process. Cronbach's alpha for the scales were computed and previously reported.[7,10] From information previously reported about longitudinal study, students' mean scores continued to decrease reflecting a less than positive change in their knowledge and attitudes related to informatics.[7,8,9,10] A comparison of the mean scores of the three subscales, clinical care process, technology and scientific use and myths, from the instrument, between the 2 groups that have completed the 4 courses is presented in Figure 1, 2 & 3. Generally, scores either remained very similar or declined slightly over time.







The second group of students, who completed the courses, in general started with higher scores. Their scores evidenced either a slight decline or a general leveling of performance. Statistical analysis yielded no significance, therefore, the mean scores were reported to document the low variation in the scores.

At the beginning to this study, the instrument seemed to meet our needs, however, the ability of the survey to capture the change in knowledge and attitudes has not been successful. As information management has continually been refined, and individuals are more sophisticated in their use and expectations, it appears that different measures need to be employed to ascertain changes over time. In this era of outcome focused studies, it is necessary to change the way in which we evaluate changes in students learning and application of informatics.

Course product outcome. The products of the fourth course are primary examples of outcomes that reflect a more sophisticated and accomplished consumer of informatic resources. As previously reported[10], student products from the first offering of the fourth course were agency specific and encompassed and reflected and wide variety of informatics application. The product outcome of the second offering of the fourth course represented an increased technological focus through the use and application of graphical interfaces to develop a homepage for the WWW. The Web Server went live April 1995. Student comments during the development, implementation and evaluation of the home page indicated realization of their increased ability to apply informatics concepts in and for clinical practice and to obtain Internet resources for clinical support.

Performance appraisal by employers. To complement the product evaluation from the fourth course, anecdotal information regarding performance appraisal of the graduates was collected. Preliminary performance appraisals from the three consortium hospitals also indicated the graduates' ability to use informatics within their clinical practice. Anecdotal reports from three agencies are positive and indicate an initial cost savings in orientation to information technology on the nursing units.

All agencies report a decrease in the amount of time required to acclimate the new graduate to existing information systems. One agency indicated that the informatic portion of orientation was substantially decreased while another indicated that the informatic portion was to be made optional for graduates of this

program. In most cases, the graduates were able to effectively utilize the information resources of their employing institutions well within the orientation period.

It is important to point out that the curriculum does not included specific orientation to those system currently in use in the employing institutions. It is also necessary to note that the lack of congruity between the three Hospital Information Systems, ie. various hardware and software configurations, did not pose a problem to graduates of this program. The lack of similarity between the systems as well as the decreased amount of time required for orientation, supports the premise that exposure to common informatics concepts within the context of information, technology and the clinical care process, can significantly add to the cost savings realized by the employing institutions. Thus, an undergraduate nursing informatics curriculum can enhance a student's ability to become a contributing member of the health care team within a relatively short period of time.

SUMMARY

In reviewing the analysis of this evaluation and the results of previous analyses, three major assertions emerged. First, we believe the inclusion of the informatics curriculum was feasible and effective. This assertion is based on positive responses from employers about graduates as well as from students' enthusiasm regarding the products of their efforts.
Second, based on the conflicting results of the paper and pencil evaluation, the use of knowledge and attitude measures to evaluate change may be misleading. The results from these measures should be viewed with caution.

Third, based on the evolving health care environment and technology, new measures must be investigated and employed to effectively evaluate an informatics curriculum. Due to the positive results obtained from the product outcomes and performance appraisals, it appears that these measures maybe useful. Those methods which incorporate new and flexible outcome measures will provide opportunities to obtain needed data to evaluate results of curriculum implementation.

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